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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
|-----------------|-------------|----------------------|---------------------|------------------|

10/676,295

09/30/2003

Andrea Urban

10191/3212A

8189

26646 7590 02/25/2009

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EXAMINER

AHMED, SHAMIM

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

02/25/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|-----------------|--------------|--|
| <i>Office Action Summary</i> | Application No. | Applicant(s) | |
| | 10/676,295 | URBAN ET AL. | |
| | Examiner | Art Unit | |
| | Shamim Ahmed | 1792 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 December 2008.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 and 10-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 12/11/08 have been fully considered but they are not persuasive. Applicants argue that Laermer et al do not teach the step of refraining from injecting a high-frequency power into the etching body in response to the existence of approximately ambipolar plasma.

Applicants also pointed out that office action of dated 9/12/08 admits that laermer et al do not teach the presence of ambipolar plasma.

2. In response to the argument, examiner states that Laermer et al teach that the high frequency power is modulated, particularly the high frequency generator is periodically switched on and off (pulsed) during the etching step after generating the plasma (col.10, lines 40-52) and aforesaid reads on the claimed limitation of refraining the high-frequency power to the etching body ---- in response to at least approximately ambipolar plasma being present.

Examiner also noted that in the previous office action, examiner meant that the plasma generated in the Laermer et al inherently includes the ambipolar plasma and examiner inadvertently use the term "obvious" to include the ambipolar because this is a general property of a plasma potential and ambipolar plasma is the existence of both the positive and negative ions. The above statement is evidenced with the following references:

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J. Taillet, "Plasma Physics: ion energy in RF plasma etching" Physics abstracts, June 1979 (see page L-224) illustrate the general property of plasma is in ambipolar status.

Ohtake Hiroto et al., "Charge-free etching process using positive and negative ions (ambipolar diffusion of ions) in pulse-time modulated electron cyclotron resonance plasma with low-frequency bias"- Applied Physics Letters, 68,2416 (1996).

J.I. Ullacia et al., "The Physics of Plasma Etching", Physica Scripta. Vol.T35, 299-308, 1991.

V.P. Derkach et al (Modeling of plasma etching in Microelectronics) illustrate that plasma discharge during etching is ambipolar diffusion of high-energy particles, see page 10.

As to claim 21, it is pointed out that the oxidizing fluorine compound includes C_1F_3 , should be " ClF_3 ".

Therefore, the previous rejection is repeated herein as follows:

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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4. Claims 1-8, 10 and 18-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Laermer et al (6,720,268).

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Laermer et al disclose a plasma etching of a silicon body to form trench, wherein injecting a high-frequency AC voltage modulated by additional low-frequency modulated voltage time to time, wherein the high-frequency is injecting into the substrate to be etched such as silicon body (18) via a substrate electrode (12) (col.3, lines 36-48, col.4, lines 39-46, col.10, lines 39-56).

Laermer et al also disclose that the modulation of the high frequency pulses comprises short and long pauses between the pulses and the low frequency of 50 Hz to 10 kHz and the high frequency generator can be periodically switched off and on (pulsed) (col.10, lines 47-52) and aforementioned reads on the limitation of refraining the high frequency power into the etching body in response to the presence of ambipolar plasma (col.11, lines 7-31).

As to the ambipolar plasma, it would be inherent to include the plasma an ambipolar status because plasma is nothing but excited or reactive species (atoms, radicals and ions, which could be in ambipolar in nature.

As to claim 19-20, Laermer teach that under etching is performed in relatively mild condition than that of etching to form the trench by increasing the density of fluorine radicals (col.7, lines 28-65).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 11-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laermer et al (6,720,268) in view of Koshimizu (5,290,383).

Laermer et al discusses above in the paragraph 4 but fail to teach adding an inert gas in the plasma.

However, in a controlled plasma etching process of silicon substrate, Koshimizu teaches the addition of inert gas into the plasma in order to stabilize the plasma (col.14, lines 29-41).

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Therefore, it would have been obvious to one of ordinary skilled in the art at the time of claimed invention to combine Koshimizu's teaching into Laermer et al's process for stabilizing the plasma as taught by Koshimizu.

8. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Laermer et al (6,720,268) in view of Hashimoto et al (5,779,925).

Laermer et al discusses above in the paragraph 4 but fail to teach synchronizing the modulation and the low-frequency modulation with one another.

However, Hashimoto et al teach that the RF bias is synchronized with the on/off modulation in order to reduce charging damage with out lowering the through put (col.16, lines 35-42, lines 66-col.17, and line 5).

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of claimed invention to combine Hashimoto et al's teaching into Laermer et al's process for reducing charging damage and for improved etching precision as taught by Hashimoto et al.

9. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Laermer et al (6,720,268) in view of Dockrey (4,799,991).

Laermer et al discusses above in the paragraph 4 and also teach that the under etching can be performed using NF_3 (col.11, lines 56-59) but fail to teach that the under etching is performed using highly oxidizing fluorine compound includes ClF_3 .

However, in a process of silicon etching, Dockrey teaches both the NF_3 and ClF_3 can be used as an efficient etchant for silicon (see claims 7 and 12).

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of claimed invention to combine Dockrey's teaching into Laermer et al's process because both NF_3 and ClF_3 are functionally equivalent as taught by Dockrey.

Conclusion

10. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shamim Ahmed whose telephone number is (571) 272-1457. The examiner can normally be reached on Tu-Fri (6:00-2:30) Every Monday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone

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number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Shamim Ahmed/
Primary Examiner, Art Unit 1792

SA